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Enhanced disinfection of wastewater by combining wetland treatment with bioelectrochemical H_2O_2 production

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Conventional Wetland WasteWater Treatment:

WasteWater;

Domestic or Agricultural

Wetland treatment

Organics (COD) & nutrient removal

Passive disinfection

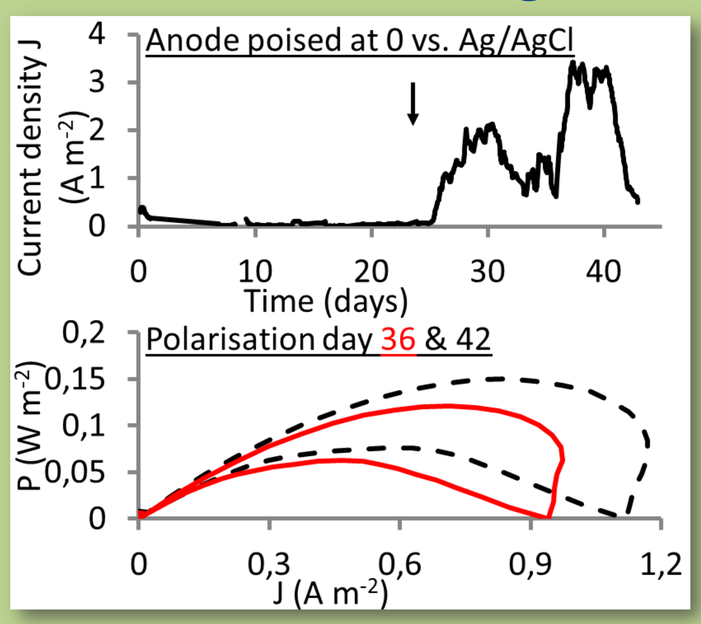
Discharge to Surface water

Conceptually New Wetland WasteWater Treatment:

Tuning of rates to match demand in water quality

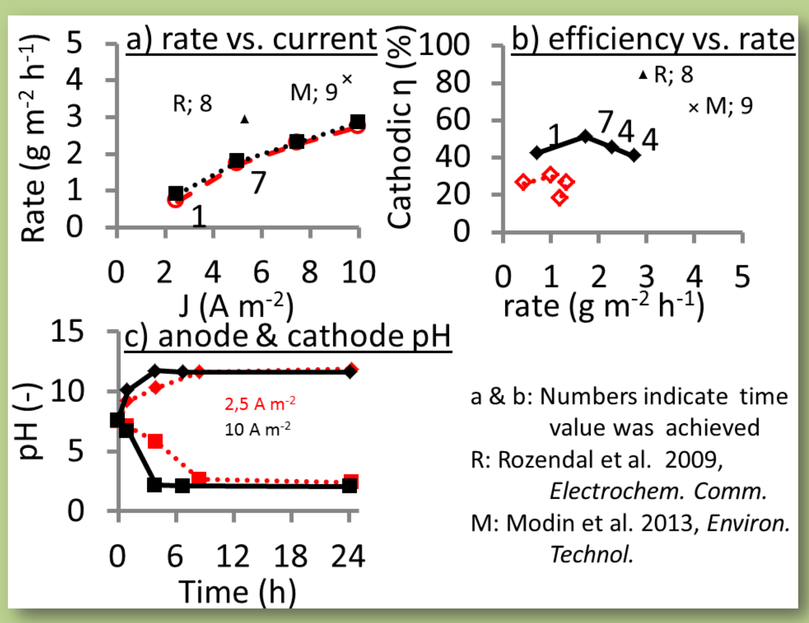
Anode performance:

- Current up to 3.5 Am^{-2}
- Anode is limited by soluble organics; arrow indicates addition of soluble organics



Cathode performance:

- No difference between wetland effluent (○) and 0.3% NaCl (■) as catholyte
- Maximum cathodic efficiency obtained after 4-7 h (◆) vs. 24 h (◇).
- pH effects can aid in disinfection

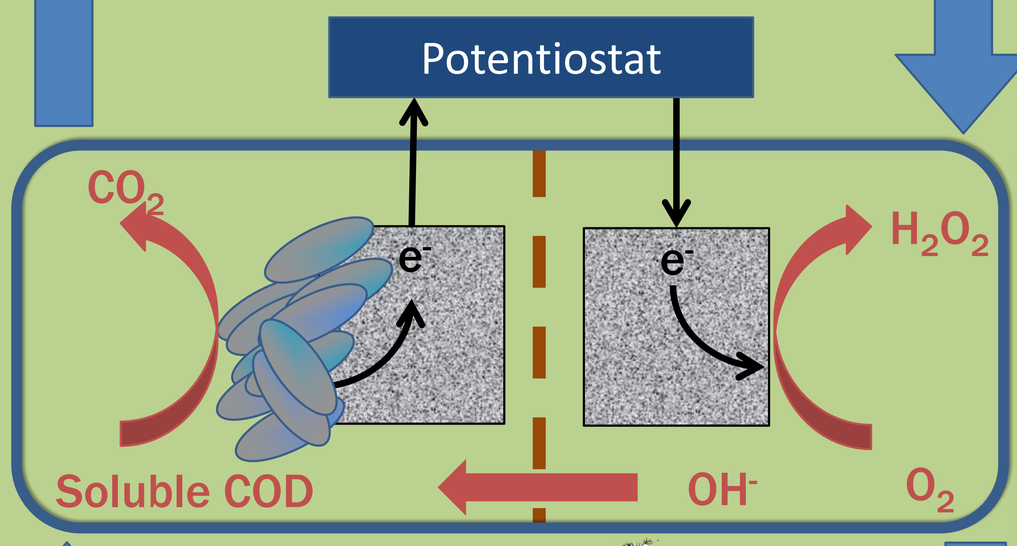


a & b: Numbers indicate time value was achieved
R: Rozendal et al. 2009, *Electrochem. Comm.*
M: Modin et al. 2013, *Environ. Technol.*

Optional Wetland treatment

Nutrient removal & polishing

Potentiostat



Wetland performance:

- Removal rate:
  27 ±18 $gCOD_{total}$ m^{-2} d^{-1}
- Effluent contained:
  161 ±187 $mgCOD_{soluble}$ L^{-1}
  17 ±35 $mgCOD_{solids}$ L^{-1}

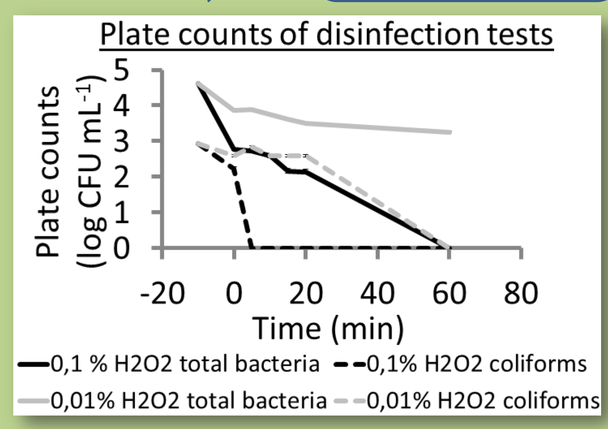
Wetland is a good rapid filter! Effluent is used to drive current production in the anode of the bioelectrochemical system (BES)

Wetland treatment

Rapid filtration & high rate solids removal

+ EXTRA COD due to rhizodeposition

Disinfection



Re-use!

WasteWater;

Domestic or Agricultural

Conclusion

Integrated wetland/BES system shows various benefits:

1) Increased wetland loading rate,
2) Increased disinfection rate, i.e. higher water quality
3) Electrical power output.

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